Jan. 15, 1963 R. J. BERNOTAS 3,073,044

SCRAPER BOWL

Filed Sept. 14, 1959 4 Sheets-Sheet 1

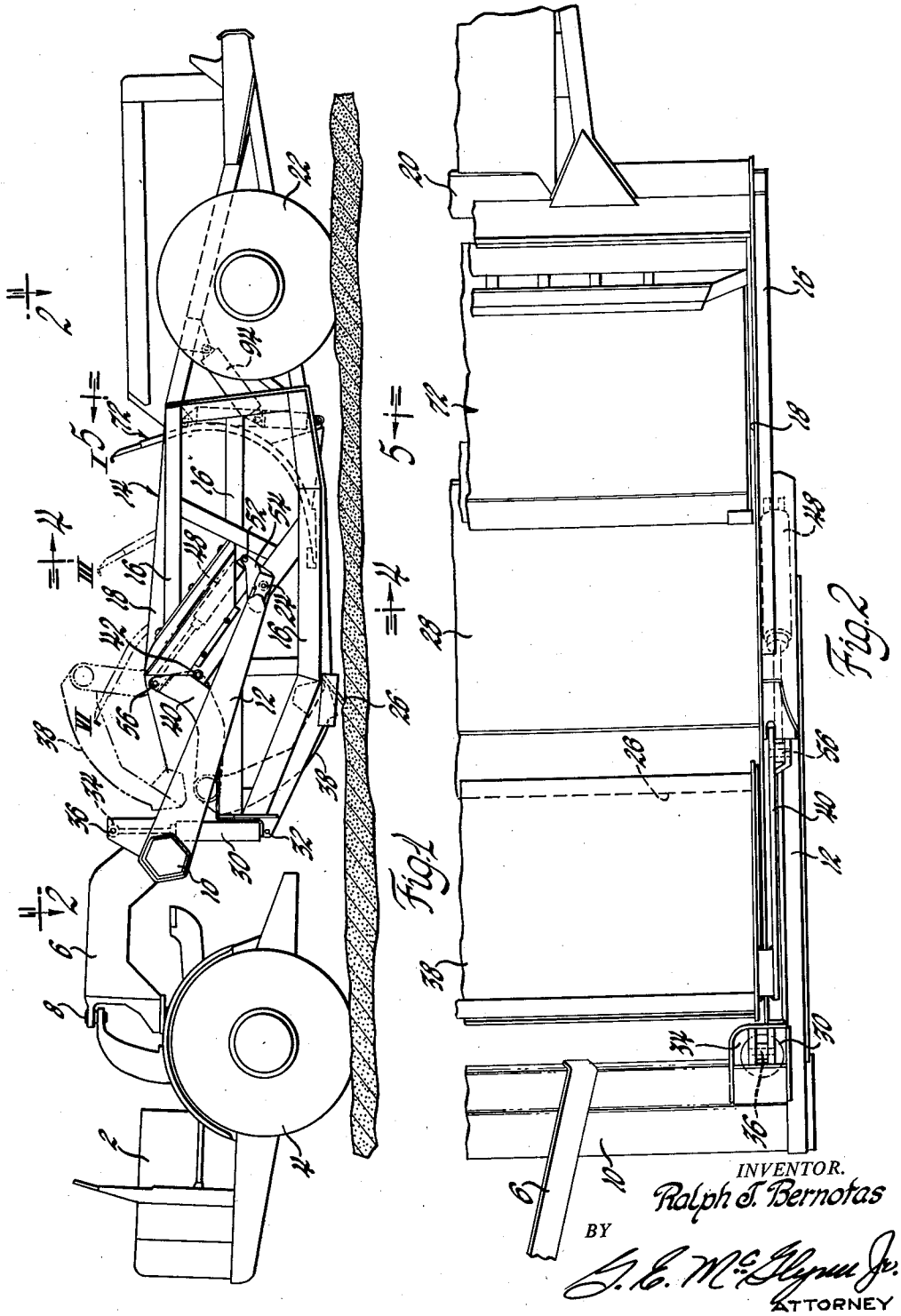


Fig. 1



Fig. 2

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SCRAPER BOWL

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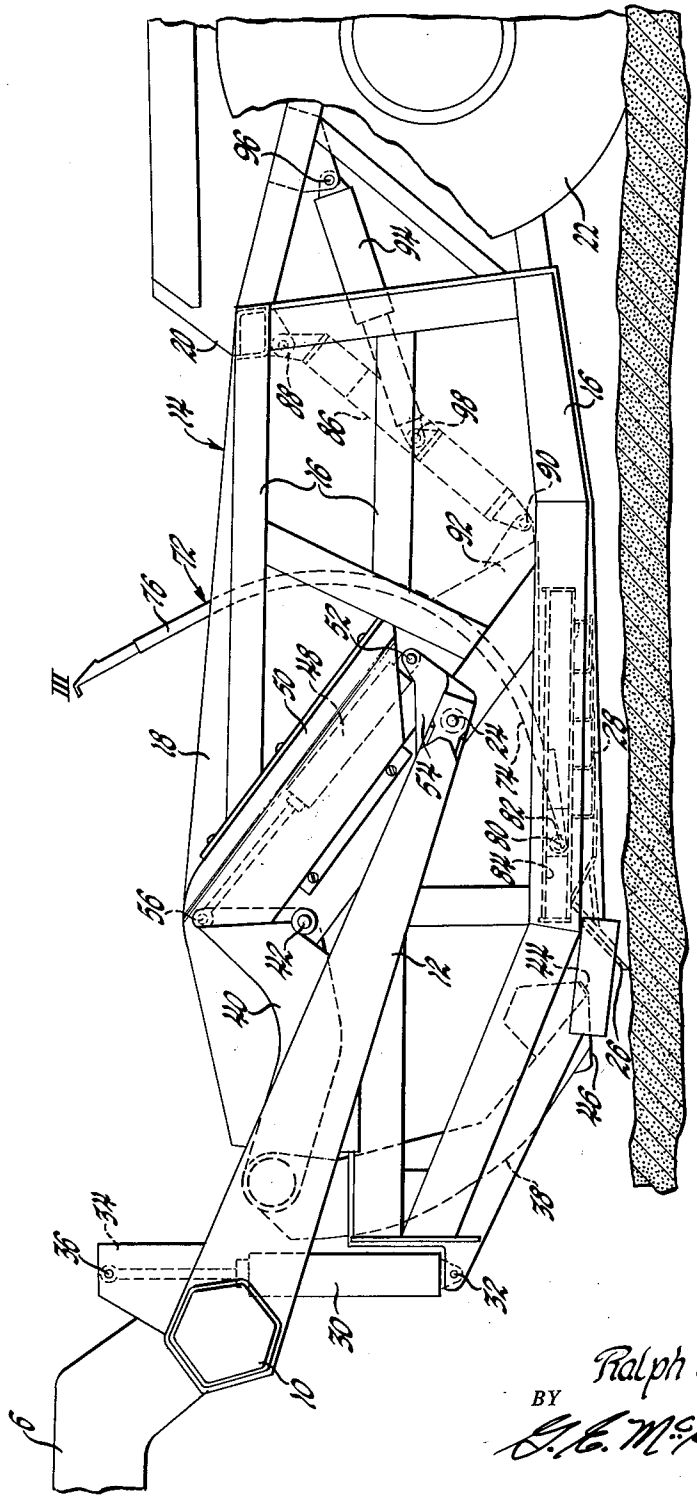


Fig. 3

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SCRAPER BOWL

Filed Sept. 14, 1959 4 Sheets-Sheet 3

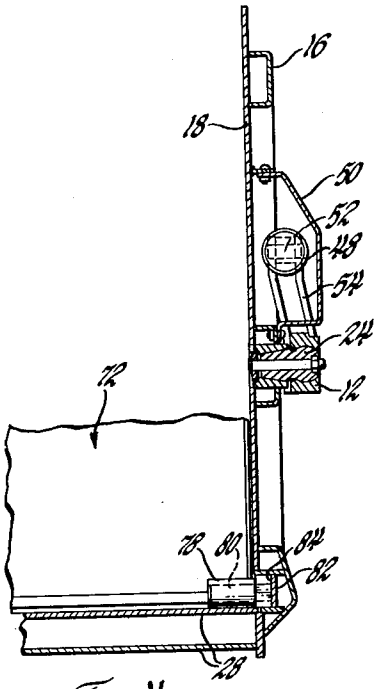



Fig. 4

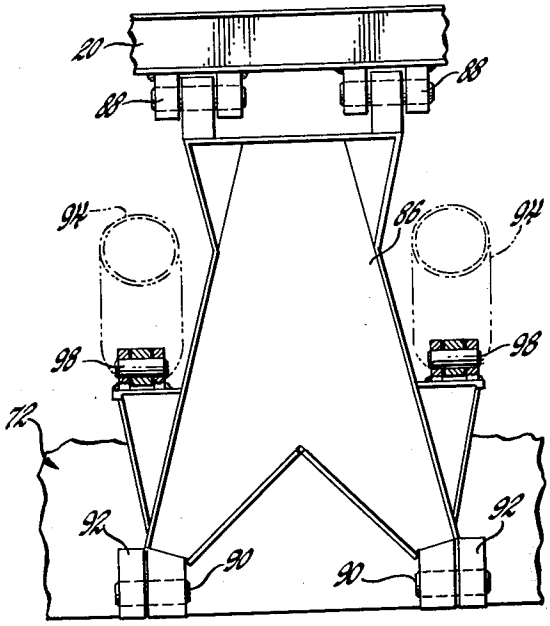



Fig. 5

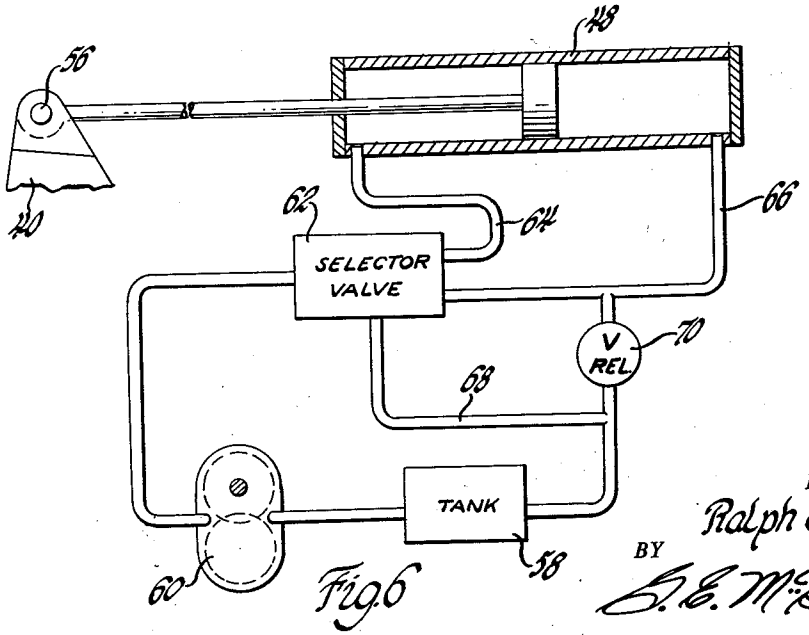



Fig. 6

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SCRAPER BOWL

Filed Sept. 14, 1959 4 Sheets-Sheet 4

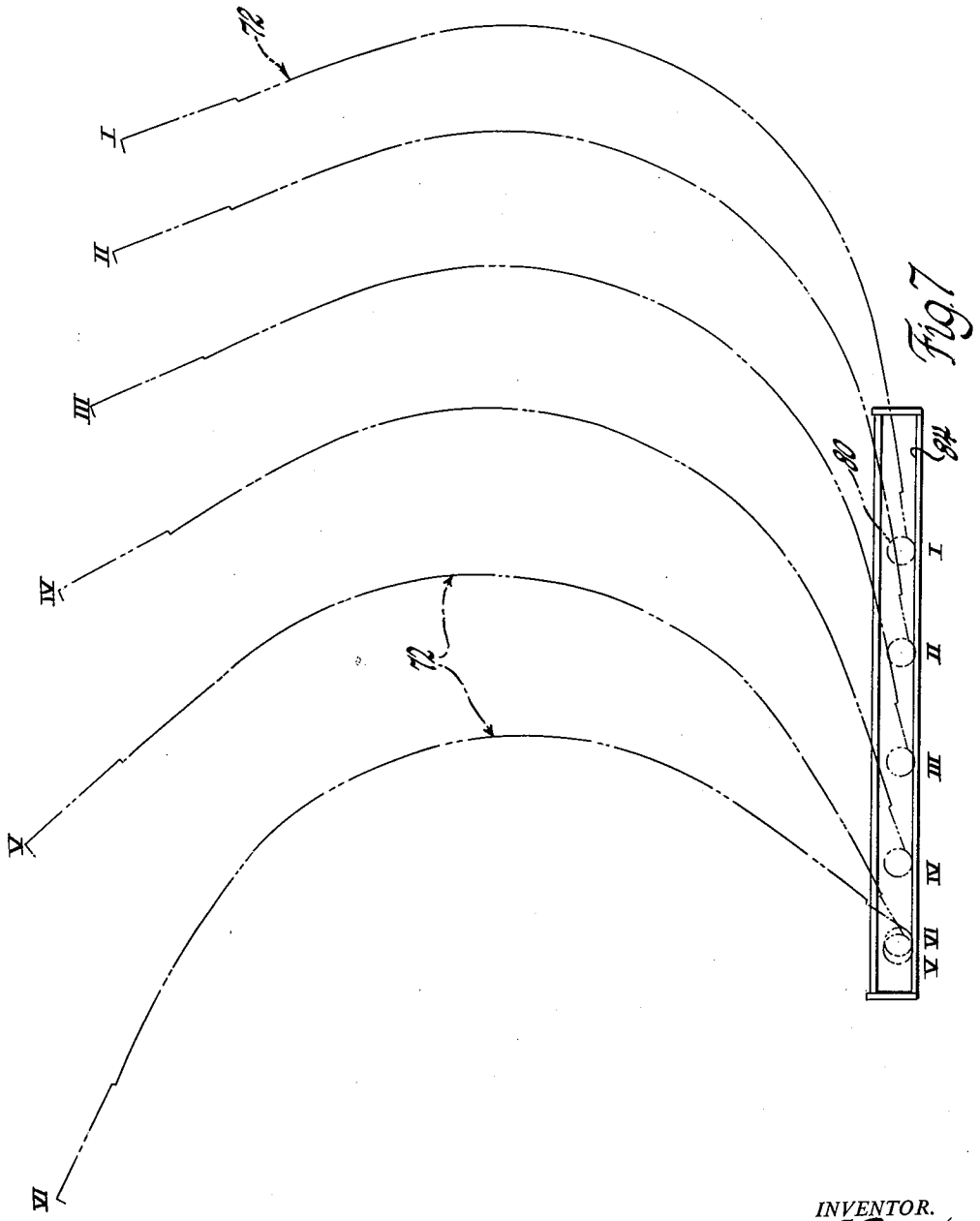



Fig. 7

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3,073,044

# SCRAPER BOWL

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2 Claims. (Cl. 37—129)

This invention pertains to a bowl construction for a digging and carrying scraper and, in particular, to a scraper bowl comprising an ejector and apron providing improved digging and ejecting action.

Digging and carrying scrapers of the type to which reference is made herein typically comprise a rubber-tired or crawler tractor connected to a drawbar or pull yoke which, in turn, is connected to a drawn scraper bowl comprising transportable bowl frame, an ejector plate in the rear of the bowl frame, and an apron adapted to selectively close or open the bowl mouth adjacent a cutting edge for receiving, carrying and discharging or ejecting loads of earth or other material. In early modern times, the bowl constructions of such a scraper vehicle were able to dig, transport and discharge loads in the order of seven cubic yards. In more recent times, and in the interest of more efficiently and economically handling loads, the sizes of such scrapers and particularly their bowls have increased to the point where it is quite common to carry loads in excess of thirty cubic yards, and even larger loads are in the offing. However, merely increasing the size of a scraper bowl does not necessarily result in the bowl being able to receive and handle a correspondingly large load. The design and coaction of the apron and ejector are important factors in insuring most efficient loading and unloading of the scraper bowl.

For example, the scraper apron and its operating mechanism should be constructed in such a manner and related to the rest of the bowl arrangement including the cutting edge of the latter to provide optimum digging characteristics to contribute to the receipt of a full load in the bowl. In this regard, a problem is presented where the apron is adapted to be closed merely by the force of gravity. In such circumstances, and while the scraper is making a cut with the apron opened to an intermediate raised position, the toe of the apron gradually piles material before it which impedes the forward cutting progress of the scraper, and also tends to push the apron upward so as to have a deleterious effect on the cutting action itself while allowing some of the load to fall from the apron while the latter is being closed.

Prior known ejector constructions may be classified as being either of the roll-out or push-out variety. A roll-out ejector is characterized by the fact that it is hinged to the scraper bowl frame adjacent the rear of the latter on a fixed transverse pivot axis, and suitable means is provided for pivoting the ejector forwardly and rearwardly in the bowl. Such ejectors have the advantage during ejection of a load of initially providing a relatively great mechanical advantage for the ejector operating member, such as a hydraulic jack or cables, while initially forcing the material from the loaded bowl followed by a decrease in mechanical advantage in accordance with the release of the load from the bowl. On the other hand, such ejectors present a problem of bowl unloading since they have a tendency to force material from the bowl more or less sporadically. In other words, as the apron is opened, a portion of the load will drop from the bowl but relatively considerable time may pass before the ejector has pivoted forwardly enough to cause additional material to fall from the bowl, and as a matter of fact, as the ejector continues to pivot forwardly, material is not evenly forced from the bowl. Moreover, during loading of a



bowl equipped with a roll-out ejector, and particularly much larger bowls now coming into use, the load has a tendency to fall down the face of the roll-out type ejector thereby preventing the formation of a heaped load in the bowl.

Such ejector operation may be compared with that of the push-out type in which a plate is merely reciprocated along the floor of the bowl from the rear of the latter toward the bowl cutting edge. With each increment of reciprocating movement of such a push-out ejector, substantially the same amount of material is discharged between the scraper cutting edge and the raised apron thereby resulting in a much more even distribution of the load. However, no mechanical advantage is provided in initially moving the load and, therefore, much larger jacks or an otherwise applied greater force must be used in initially moving the ejector. Moreover, in loading a bowl equipped with a push-out type ejector, the material being received past the bowl cutting edge has a tendency to fall from the ejector plate as it is being reciprocated rearwardly, thereby preventing attaining a heaped bowl.

In view of the above considerations affecting prior bowl design, it is a principal object and feature of this invention to provide a scraper bowl comprising an ejector and apron which cooperate in such a manner as to provide improved loading and ejecting or discharging characteristics, and resulting in the bowl being able to receive, carry and eject heaped loads more efficiently and economically.

It is yet another and more specific object of this invention to provide a scraper bowl comprising a push-out roll-out ejector having the most desirable features of prior art ejectors in receiving and discharging a load while eliminating the more problematical features thereof.

It is yet another object and feature of this invention to provide an improved apron for a digging and carrying scraper bowl comprising operating means for positively holding the apron in any selected position, such as a closed or digging position, to provide an improved loading action for the bowl.

It is yet another object and feature of this invention to provide a hydraulic apron-operating mechanism which will not only positively hold the apron in a selected position with respect to the bowl but will also function to close the apron automatically after the digging operation in response to lifting of the bowl to the carry position.

In general, these and other objects of the invention are attained in a scraper bowl connected to a prime mover by means of the usual drawbar having pull arms, and comprising hydraulic jacks mounted on the drawbar and connected to the main bowl frame for controlling pivotal movement of the latter about the drawbar pull arms between a lower digging position and an upper carrying position, an apron including support arms pivotally connected to the bowl frame for adjustment of the apron among various positions including a lower position closing the mouth of the bowl, an intermediate position raised slightly above the bowl cutting edge for digging purposes, and an upper raised ejecting position, a pair of double-acting fluid-operated apron jacks with one end of each of the jacks being connected to a respective drawbar pull arm and the other end pivotally connected to a respective apron arm, and being operable in extension and contraction, respectively, to pivot the apron in a closing and raising direction, relief valve means connected to an end of each of the apron jacks and operable to permit fluid to be exhausted from the latter to permit jack retraction upon lifting the bowl sufficiently above the digging position as to engage the toe of the apron, and an ejector construction mounted for concurrent longitudinal transla-

tional and pivotal movement through the bowl during the loading and ejecting operation.

The specific nature of the invention and the manner in which the foregoing objects are attained will become more apparent hereinafter as the description of the invention proceeds, and in which reference is made to the drawings in which:

FIGURE 1 is a side elevation of a digging and carrying scraper illustrating a preferred embodiment of the bowl construction of this invention;

FIGURE 2 is an enlarged plan view of the bowl construction taken on line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged side elevation of the bowl construction of FIGURE 1;

FIGURE 4 is an enlarged fragmentary sectional view taken on line 4—4 of FIGURE 1;

FIGURE 5 is an enlarged fragmentary sectional view taken on line 5—5 of FIGURE 1;

FIGURE 6 is a schematic illustration of the apron-operating mechanism; and

FIGURE 7 is a schematic illustration of ejector action during digging and discharging a load.

Referring now to the drawings, there is shown a scraper vehicle comprising an overhung tractor 2 having an engine connected in drive transmitting relationship with the tractor wheels 4. The drawbar or gooseneck 6 composed of rearwardly diverging arms in the usual manner is connected in a conventional manner to the tractor 2 on a vertical hitch and steering axis indicated at 8. The gooseneck or drawbar 6 further includes a transversely extending rigid torque tube 10 to each end of which there is rigidly attached a rearwardly extending pull arm 12. The main bowl frame 14 includes transversely spaced longitudinally extending structural members 16 which carry bowl side walls 18 while other structural reinforcing members as indicated at 20 span the longitudinal members and form a rigid frame unit. The main bowl frame 14 is mounted for transportation on the rear wheels 22 driven by an engine mounted on a rearward extension of the frame. The rearward end of each pull arm is provided with a socket pivotally connected to the ball members 24 carried on the outside surfaces of the bowl side walls 18. A cutting edge 26 extends transversely between and is rigidly secured to lower forward portions of the side walls 18 to form the mouth of the scraper bowl. A main fixed bowl floor 28 extends transversely between the bowl side walls 18 from a point adjacent the rear of the cutting edge rearwardly to a point intermediate the ends of the main bowl frame.

In order to control relative pivotal movement between the pull arms 12 and the bowl frame 14 about the transverse axis of the balls 24, a single-acting fluid-operated bowl jack 30 is pivotally connected to each of the forward corners of the main bowl frame as indicated at 32 and extends upwardly into a well 34 carried at each end of the torque tube 10, and is pivotally attached therein as indicated at 36. Any conventional fluid pressure system may be employed, as will be quite apparent, to cause these jacks to contract thereby resulting in the scraper cutting edge 26 being lifted from its lower digging position in engagement with the ground to a raised carrying position. Fluid is exhausted from the bowl jacks to permit gravity to lower the bowl.

The scraper apron 38 is generally arcuately shaped in vertical cross section, extends transversely between the bowl side walls, and has rigidly secured to each end thereof a support arm 40 pivoted at 42 to each of the bowl side walls. As will be apparent to those skilled in the art, the apron toe 44 is adapted to open and close the mouth of the bowl in cooperation with the cutting edge 26, while a transversely extending shoe 46 is mounted on the face of the apron adjacent its toe. In order to control opening and closing movement of the apron, a pair of fluid-operated jacks 48 are employed, one to each side of the vehicle, and mounted in housings 50. One end of each jack is pivotally connected at 52 to a bracket 54 secured to a respective pull arm 12, while the other end thereof is pivotally connected at 56 to an apron support arm 40. The apron jacks 48 are double-acting so as to maintain the apron in any selected position, and to provide a positive force for closing the toe 46 of the apron upon the cutting edge 26 to retain all loaded material within the bowl.

The apron jacks 48 not only provide a positive force for maintaining the apron in any selected position or for positively closing the apron, but they also act to close the apron automatically after loading. In this regard, the apron is disposed as shown in FIGURE 3 during the digging or loading operation, in which the toe 44 of the apron is raised a small amount away from the cutting edge. After loading, it will be appreciated that the bowl jacks 30 will be retracted to lift the cutting edge 26 from the ground. As a result, relative pivotal movement occurs at the axis of the ball members 24 between the bowl frame 14 and the pull arms 12. Inasmuch as the apron jacks 48 are pivotally connected to the pull arms while the apron support arms 40 are pivotally connected to the bowl frame, the hydraulically locked apron jacks 48 automatically pivot the apron about its pivot axis until such time as the apron toe 44 engages the cutting edge 26. As a result, the apron is closed automatically as the bowl lift jacks 30 are operated. In order to prevent damage to the hydraulic system, means is provided for exhausting fluid from the lower or cylinder end of the apron jacks 48 should further upward bowl movement occur after the apron closes.

The hydraulic system for operating the apron jacks 48 is disclosed schematically in FIGURE 6. This figure of the drawings depicts a conventional hydraulic system including a tank 58 supplying a pump 60 which, in turn, supplies fluid under pressure to the main selector valve 62 which may be operated to control fluid flow through lines 64 and 66 to the ends of each jack 48. In any given instance, the valve is operated to direct oil under pressure to one selected end of each of the apron jacks 48 while permitting exhaust from the other end of the jack through valve 62 and line 68 to tank. However, a relief valve 70 is located in the line 66 to the cylinder ends of the bowl jacks and set at some predetermined relief pressure. As a result, during automatic closing of the apron as aforedescribed, the relief valve 70 will permit exhaust of oil from the cylinder end of the apron jacks to tank should further upward lifting movement of the bowl tend to shorten or contract the bowl jacks thereby causing the predetermined relief pressure to occur in the line 66.

The rearward portion of the scraper bowl floor and the rear bowl wall is formed by an ejector plate 72 generally arcuately shaped in vertical cross section to form a lower floor portion 74 and rear wall portion 76 upstanding therefrom. As will be apparent, the ejector extends transversely between the side walls of the main bowl frame. Laterally opening bushings 78 are secured to the side edges of the lower floor portions of the ejector plate and are adapted to receive pivot pins 80 connected to slide members 82 reciprocably mounted in cooperating guide and support channels or tracks 84 extending longitudinally of the main or fixed scraper floor 28 generally in the plane of the bowl side walls 18. An ejector lever 86 of substantially A-frame configuration is pivotally connected by two laterally spaced ears to a main frame structural member 20 as indicated at 88 with the ejector lever disposed symmetrically with respect to the center line of the scraper. The lever depends from this point of connection and, at its lower end, is provided with another pair of ears respectively pivotally connected at 90 to brackets 92 rigidly secured to the ejector plate. A pair of double-acting fluid-operated ejector jacks 94 are pivotally connected to the main bowl frame on a transverse axis indicated at 96, and at 98 to brackets on the ejector lever intermediate the ends of the latter.

It will now be apparent that extension of the ejector

jacks 94 will result in clockwise pivoting movement of the ejector lever 86 about the axis of its connections 88. As the ejector lever so pivots forwardly, the slide members 82 translate or reciprocate forwardly in tracks 84 while the ejector itself pivots concurrently about the transverse axis defined by the pivot pins 80 and fixed relative to the ejector. Moreover, during the initial stage of expansion of the ejector jacks 94, it will be apparent that a relatively great mechanical advantage is present to assist in initiating the discharge of the load from the bowl without requiring inordinately large jacks. As the mechanical advantage decreases, the power supplied by the ejector jacks 94 is still quite sufficient in moving the load in the bowl inasmuch as some of the load is progressively being discharged. The specific nature and significance of the combined push-out roll-out action of the ejector 72 both in discharging a load and while a load is being dug will become more apparent from a consideration of FIGURE 7, in which various representative ejector positions are indicated by Roman numerals which, for convenience, are similarly employed in FIGURES 1 and 3 to locate corresponding ejector positions.

With reference to a consideration of FIGURE 7, the ejector jacks may be assumed to have a total stroke of approximately twenty-five inches which, for the purpose of illustration, may be considered in five inch increments. As the ejector jacks are extended each of the aforementioned five inch increments, the ejector plate 72 is moved forwardly through the bowl from the rearmost position I through positions II through V to the final dumping or ejecting position VI. Similarly, the ejector support pins 80 connected to the reciprocable ejector support slides 82 move through corresponding positions as indicated in FIGURE 7 of the drawings. Therefore, it will be apparent that during ejection beginning from the rearmost position I, the ejector 72 moves forwardly through the bowl while concurrently pivoting about the axis of the pins 80. The translational or reciprocable component of movement of the ejector is initially dominant, but the ejector increasingly pivots about its support pins as it moves through the bowl. In other words, up to approximately position IV, the ejector translates or reciprocates to a relatively great extent while also pivoting forwardly to a lesser extent. From position IV to position V, the force applied to the ejector continues to reciprocate the latter while pivoting it forwardly to a greater extent than before. At position V, the ejector lever structure gives a final kick to the ejector causing the ejector support slides to move rearwardly to a slight extent to position VI as the ejector is pivoted forwardly to a relatively great extent. Naturally, the ejector will move in a reverse fashion upon contracting the ejector jacks. Thus, the ejector construction aforedescribed has the advantage of a purely roll-out type ejector in providing an initial mechanical advantage to move material from the loaded bowl thereby avoiding the necessity for inordinately large ejector jacks, while additionally incorporating the advantage of a push-out ejector in reciprocating through the bowl for even discharge of the material therefrom. Similar advantages are obtained in loading the bowl as will appear hereinafter as the operation of the vehicle is described.

In loading the scraper bowl, the bowl lift jacks 30 are permitted to extend by gravity to an extent sufficient to dispose the cutting edge 26 in contact with the ground or other material to be dug. The apron jacks 48 are actuated so as to dispose the apron in the position shown in FIGURE 3 with the apron toe 44 thereof disposed a relatively slight distance from the cutting edge 26. Also, the ejector 72 is disposed approximately in position IV. As the cutting edge 26 begins to dig into the material, the resistance to the cut acting against the cutting edge causes the latter to be drawn down into the material thereby bringing the area of the apron adjacent the apron toe 44 down into engagement with the ground. Thus, the apron shoe 46 is provided to ride along the surface of the ground and prevent material from piling up beneath the toe of the apron. As a result, there is less tendency for material to pile up in the area of the apron toe since the forward running shoe forces the material loosened by the cutting edge into the bowl. Additionally, the apron is maintained in the pre-selected cutting position by the locked double-acting apron jacks 48. Thus, the cutting edge and the toe of the apron are maintained in the desired position for the cutting operation for the most effective loading of material into the bowl.

As the soil is initially cut, material boils upwardly into the bowl between the apron and ejector which, as aforementioned, is in the initial loading position IV. The path of this material is almost vertically upwardly and, as the material rises within the confines of the ejector and apron, it mushrooms out between the two. The result of this loading action is that a cleavage line exists; on one side of this line, material is boiling over into the bowed apron 38 and on the other side it is boiling over into the ejector 72. When the area between the apron and ejector is heaped and resistance to cut is correspondingly increasing, the operator operates the ejector mechanism to move the ejector 72 rearwardly such as from position IV to position III. As the ejector is so moved, the pressure of the soil in the aforementioned cleavage line holds the material substantially to a heaped position at the top of the ejector and apron as more material enters the bowl. Thereafter, the ejector is similarly moved rearwardly with the objective in mind of keeping the material heaped to the top of the ejector and apron as more material enters along the aforementioned cleavage line. Finally, the ejector reaches the position I, and the bowl is heaped to the top of the ejector and apron. Thus, the rearward rolling action of the ejector cradles the load rearwardly as the material boils along the cleavage line into the bowl, and the material is prevented from dropping downwardly along the face of the ejector as is the tendency with a purely roll-out or push-out type ejector.

With the ejector in position I and the bowl loaded, the bowl jacks 30 are contracted causing the main bowl frame 14 to pivot clockwise relative to the mounting of the drawbar pull arms 12 to the balls 24. In lifting the bowl frame upwardly, the apron jacks 48 remain locked and cause the apron to pivot about the axis 42 to move the apron toe 44 into ultimate engagement with the cutting edge 26 to close the mouth of the bowl as shown in full lines in FIGURE 1. After the bowl mouth is closed and should further lifting occur to put the latter in a carrying position, the apron jacks 48 have a tendency to contract and if sufficient to establish a predetermined pressure in the cylinder line 66 will cause the relief valve 70 to open to permit jack retraction as aforedescribed. Naturally, if desired, the operator may operate the apron jacks to positively close the apron rather than relying upon automatically closing it.

After the load has been transported to the dumping area, the apron is raised to its upper ejecting position as indicated in dotted line in FIGURE 1, and the ejector is moved forwardly within the confines of the bowl side walls to dump the load. As previously described, the ejector both translates through the bowl and pivots about a transverse axis defined by the support pins 80 and fixed relative to the ejector to evenly discharge the load. Moreover, in moving from position V to position VI, a final roll-out kick is given to the ejector to aid in cleaning the latter of any material having a tendency to cling thereto.

While but one form of the invention has been selected for a descriptive illustration thereof, other forms will be apparent to those skilled in the art. Therefore, the embodiment shown in the drawings is merely for illustrative purposes, and is not intended to limit the scope of the invention which is defined by the claims which follow.

I claim:

1. A scraper bowl comprising a transportable bowl frame including transversely spaced longitudinally ex-

tending side walls, a fixed bowl floor extending transversely between said side walls intermediate the ends of said bowl frame, a transversely extending ejector plate arcuately shaped in vertical cross section to form a lower floor portion and rear bowl wall upstanding therefrom, said plate being positioned in the rear of said bowl while transporting a load therein, means connecting a fixed transverse axis on said ejector floor portion to said side walls for longitudinal forward translational movement relative thereto and concurrent forward pivotal movement of said ejector plate about said axis in ejecting a load from said bowl, an ejector operating lever having first and second points thereon respectively pivotally connected to the bowl frame and ejector plate, the second point on said lever being located substantially in a horizontal plane passing through the fixed transverse axis on said ejector floor portion when the ejector is in fully retracted position, and a fluid-operated jack having one end pivotally connected to said bowl frame and the other end pivotally connected to said lever to pivot the latter forwardly about its connection to said bowl frame, said lever being so located in the normal load retaining position of the ejector that the included angle opening toward the ejector and formed by a center line passing through the first and second points and a horizontal center line passing through the first point is no greater than 90° so that upon any forward movement of the lever by the jack the lever is moved about the first point to cause said second point to translate and raise the rear bowl wall of the ejector about said transverse axis concurrently while moving the latter longitudinally between the side walls.

2. A scraper bowl comprising a transportable bowl frame including transversely spaced longitudinally extending side walls, a fixed bowl floor extending transversely between said side walls intermediate the ends of said bowl frame, a transversely extending ejector plate arcuately shaped in vertical cross section to form a lower floor portion and rear bowl wall upstanding therefrom, said plate being positioned in the rear of said bowl while transporting a load therein, longitudinally extending tracks respectively mounted opposite each other on the lower portions of said side walls, support means projecting laterally from the floor portion of said ejector plate and defining a transverse pivot axis fixed relative to said ejector plate, said support means being engaged in said tracks for longitudinal forward translational movement therein and concurrent forward pivotal movement of said ejector plate about said axis in ejecting a load from said bowl, an ejector operating lever having first and second points thereon respectively pivotally connected to the bowl frame and ejector plate, the second point on said lever being located substantially in a horizontal plane passing through the fixed transverse axis on said ejector floor portion when the ejector is in fully retracted position, and a fluid-operated jack having one end pivotally connected to said bowl frame and the other end pivotally connected to said lever to pivot the latter forwardly about its connection to said bowl frame, said lever being so located in the normal load retaining position of the ejector that the included angle opening towards the ejector and formed by a center line passing through the first and second points and a horizontal center line passing through the first point is no greater than 90° so that upon any forward movement of the lever by the jack the lever is moved about the first point to cause said second point to translate and raise the rear bowl wall of the ejector about said transverse axis concurrently while moving the latter longitudinally between the side walls.

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